Exploring IT enabled network organisations in health care

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Exploring IT-Enabled Networked Organisations in Health Care: Emerging Practices and Phases of Development

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Abstract

This paper describes an exploratory study of networked organisations in the health care sector. Based on a review of literature on networked organisations, a theoretical framework is developed and applied to three case studies. The results indicate that networked organisations in health care services are mainly driven by socio-economic and organisational conditions, in which information and communication technology plays an increasingly important facilitative role. Furthermore, the case findings indicate that networked organisations in health care develop through different phases: from pilot practices to institutionalisation. Lessons are drawn from the case studies for practice and the applicability of the theoretical framework.

1. Introduction

It is a truism that the -international and domestic- health care sector is experiencing rapid change. While the role of information and communication technology (IT) is certainly not new, the increasing dynamics of organisational and socio-economic developments, and the rapid technological advancements do emphasise the complexities and dynamics of a changing health care environment. In this environment of complex and dynamic processes, networked organisations have become 'en vogue' because of their flexible approach [16].

In the Netherlands, there are several issues that influence the organisation of health care services. There are political issues of health care equality; economic issues addressing the financial position of medical specialists [22]; the social-demographics of an improved healthcare system that leads to higher life-expectation leading to higher costs; and the issue of the technological progress, stretching the border of what is medically possible [9]. The annual budget for Dutch healthcare in 1999 was 32,3 billion Euro, close to 9% of the gross national product, of which 40% is allocated to curative somatic care (largely hospitals). Dutch hospitals have about 200.000 employees, more than 3% of the available working population. Hospitals include academic (8), general (103) and categorical (33; for example rehabilitation centres) hospitals [9].

Dutch and global healthcare is subject to constant impulses to improve efficiency en effectiveness. For example: budget restriction by the government makes it necessary to improve efficiency and lower costs; the general need to improve patient care makes it necessary to improve effectiveness. Once a cottage industry of physicians, hospitals, specialised medical centres, general practitioners, the Dutch health care sector is now becoming aware of the potential value of integrated services and the collaborative advantage of networking. Health care networks, enabled by advances in IT, are forming to meet patient's demands, improve efficiency and effectiveness, and leverage knowledge and expertise through an inter-institutional network [16].

Funded by the Telematics Instute, and in collaboration with several Health Care organisations[i], this study employed an exploratory case study design for describing and analysing three networked organisations in health care. Case studies are the preferred strategy when the investigator has little control over events, and when the focus is on a contemporary phenomenon within a real-life situation [24]. When studying novel -inter and intra- organisational phenomena, case study research is particularly relevant. The aim of the study is (*i*) to develop and contribute to the understanding of how networked organisations are formed, particularly in the context of health care, and (*ii*) to explore how IT infrastructures and applications support and shape the formation of networked organisations. Based on a review of the literature, a theoretical framework is developed, and used as an instrument for describing and analysing the case findings.

The investigation comprised of semi-structured interviews with directors, department managers, project managers, technical staff and end-users of organisations participating in the network. Furthermore, project plans and notes were gathered and analysed for further information pertaining to the dimensions described in Table 1. Document analysis is used to enrich and verify interview data. The validity and reliability of the study are enhanced through the use of multiple sources of information, the review of draft case reports by the interviewees, and the use a standardised case study protocol [20,24].

In the remaining sections of this paper we present the theoretical background and framework of this multiple case study (Section 2), describe the case study findings (Section 3), and discuss the lessons learned and future research (Section 4).

2. Theoretical Background and Framework

In the growing literature on networked organisations, different definitions, synonyms and typologies can be found for describing a networked

organisation [19]. In general, three characteristics of networked organisations are identified. A set of organisational arrangements are regarded as a networked organisation if: (*i*) the network consists of at least three nodes; (*ii*) each node has independent decision-making authority regarding relationships with other nodes; and (*iii*) the relationships between the nodes exist for an extended period in time and for more than one transaction. In the context of health care, networked organisations can be described at different levels:

- inter-organisational: e.g., transmural care projects;
- intra-organisational: e.g., patient-oriented processes;
- inter-departmental: e.g., multidisciplinary sessions;
- intra-departmental: e.g., team-nursing.

The theoretical framework developed and used in this study is based on the theory of Contextualism [17]. The theory of Contextualism builds forth on theories concerned with the organisational, economic, technical and political aspects of strategic change and organisational innovation. Both organisational and technical aspects of change, at different contextual levels, are addressed. Given (a) the aim of this study to explore how *technology* infrastructures and applications support and shape the formation of networked *organisations*, and (b) the *multi-level nature* of networked organisations, the theory of Contextualism is particularly suitable. Contextualism describes strategic change in terms of conditions, arrangements, processes, and outcomes in their context. Applying these generic constructs of contextualism to the field of networked organisations, the following theoretical framework is developed (Table 1). The framework consists of 5 dimensions and is operationalised into variables. These variables are used to develop 28 open questions as a research instrument [19].

Table 1. Theoretical Framework for Networked Organisations

Factor	Dimension	Description	Sample Question
Context	Strategic drivers and incentives for networking	The objectives, motives, perceptions and expectations of organisations and stakeholders involved in the network [1,2,6,7,8,15].	What are the business and IT drivers for networking and how are these perceived by the nodes in the network?
Conditions	Enabling conditions for networking	The conditions that enabled or stimulated the emergence and formation of the network [6,7,8,13,14,15].	What are the critical organisational and managerial conditions and capabilities for networking?
Arrangements	Design of the network	The structuring of the network responsibilities, decision-making units, and coordination mechanisms [1,2,7,8].	What organisations are involved in the network, with what functions, tasks and responsibilities?
Processes	Functioning of the network	The inter- and intra-organisational processes and (transactional, informational) activities [1,6,7,8,15,21].	What are the primary (core) processes in the network and what is the role of IT?
Outcomes	Performance of the network	Impacts and effects (unexpected) of the network [1,2,7,8,13,14].	When is networking (perceived) as successful, and how are the impacts shared across the network?

3. Case Studies on Networked Organisations in Health Care

In this section the case studies on networked organisations in the health care sector are described and analysed. The cases were selected to capture the multilevel nature of networked organisations in health care. The first two cases, the Bosch Medicentre Network (BMCN) and the Roessingh Rheuma Network (RRN), and are located in the Netherlands. The third case study, the Renal Telemedicine Network (RTN), is located in Australia and was analysed through secondary case reports for analytical and comparative purposes.

3.1 The Case of the Bosch Medicentre Network

On the 6th of January 1990 the Willem-Alexander Ziekenhuis and the Groot Ziekengasthuis merged into the Bosch Medicentrum. The Bosch Medicentrum is a general hospital with a capacity of 780 clinical beds, 1.900 fte's (full time equivalents), 2.600 employees and 140 medical specialists (divided in 30 specialisms).

The annual budget is 118 million Euro (1998, the honoraria budget of medical specialists included), of which 65% is used for personnel, 20% for materials and 15 for the total hospital infrastructure. The Bosch Medicentrum has regional and national collaborations with other general hospitals.

In seeking improved efficiency and effectiveness, the Bosch Medicentrum in 1996 started a reorganisation evolving from a facility management into a product-line management organisation structure. The common function-oriented management organisation structure is seen as an intermediate step [5,17]. Units (9 Care Units, 8 Supporting Care Units and 2 Service Units) were introduced to give the middle management the flexibility needed. In the Dutch healthcare this process is called ‘tilting’.

The maximum size of the Bosch Medicentre network is 2.600 employees and 140 medical specialists. The network organisation takes place within the hospital. Its units are the nodes in the network. The nodes involve hospital-personnel and medical specialists, working together, attending to the patients needs. Most medical specialists form a group within their specialism that has a separate legal entity. They form small companies within the hospital.

Dutch hospital healthcare has several barriers that prevent efficient and effective control of hospital organisations. Hospitals are not-for-profit organisations. The market does not freely determine barriers for entry and exit to this network, hospital healthcare is considered to be a merit-good. One of the main barriers is that the current system of budgeting can work contra-productive on a micro-economic level [18]. Efficient and effective control of hospital organisations depends on ability to determine the relation between input and output [4]. Production parameters like admissions, short stays, nursing days and out-patients are still the backbone of the Dutch system budgeting hospitals. In an effort to stabilise the costs of Dutch healthcare lump sum financing is now widely introduced. Obviously these, legislative ways of relating input and output influence the information systems of hospitals [23]. A more specific system of product-definition is needed. These changes demand a higher flexibility of IT. This is an interesting challenge, most hospital information systems (HIS) were originally designed for hospitals with a facility management structure.

Dutch hospitals with more than 500 clinical beds on the average spend 1,7 billion Euro on hospital automation annually. HISCOM/Baan, (previously BAZIS, SMS and SIAC), the main provider of HIS, holds more than 50% of the market share. The area of specific hospital processes (e.g. rehabilitation) is mostly covered by branch related providers. The more open character of hospital information systems supports this trend. HISCOM/Baan is re-engineering its software to comply to the Health Level Seven exchange protocol [3].

The Bosch Medicentrum uses the majority of the HISCOM/Baan hospital information systems (68 of 109, 60%). In the area of specific hospital processes, information systems of other providers are used (9). Mainly hospital middle management, the functional operators and medical specialists are involved in the organisation and management of IT [22]. For each part of the hospital information system at least one functional operator is assigned (totally 30). The functional operator is stationed at the unit and responsible for the quality and continuity of their part of the hospital information system. Functional operators exchange knowledge with colleagues grouped by care, supporting care and services. Technical support, implementation and central computing facilities are outsourced. The total outsourced costs of hospital information systems in 1998 were estimated at 4,3 million guilders (including 0,8 million guilders depreciation on computer equipment). The top-15 (20 percent) of the information systems induced 70 percent of the costs and 80 percent of the total computing capacity.

The demand and supply of IT is controlled centrally by an automation co-ordinator. In an annual budgeting cycle, plans concerning IT priorities are set by a committee. On an informative level plans are discussed in the groups of functional operators. Main concern in setting priorities is to fit the plans to the budget. A large amount of the budget goes to outsourcing, leaving only a small budget for innovation from within the organisation. However, units are free within the hospital policy to substitute a part of their budget to finance plans concerning IT. In the near future the centrally controlled budget will be decentralised to the units.

The Bosch Medicentre network is perceived as successful when higher efficiency and effectiveness in control are reached, resulting in reduced costs without loss of quality in hospital healthcare. Financial and business outcomes contribute to the mission statement of the Bosch Medicentrum, i.e. providing a complete and coherent package of medical care that is recognisable and attractive for the patients from the region, in an integrated medical care organisation where employees can work under good conditions. Integrated medical care reaches well beyond the organisational boundaries of the Bosch Medicentrum. The first transmural care projects have started. The performance of IT is determined by how extensively and adequately it supports the network organisation. Flexibility in organisation and IT remains a key factor in enabling the networked organisation.

3.2 The Case of the Roessingh Rheuma Network

Roessingh Research and Development is a research unit of the Roessingh Concern and employs approximately 40 people. The Roessingh Concern has approximately 140 beds and approximately 40.000 rehabilitation treatments per year. It is one of the largest rehabilitation centres in the Netherlands.

The Rheuma network was formed when a proposal was submitted to the Commission for Chronically Ill Patients to formalise and institutionalise communication lines between Medical Spectrum Twente (MST) and local clinics, and Leiden University Medical Centre (LUMC) and local clinics [16]. This proposal was submitted in August 1998 and was a joint effort of both MST and LUMC. The Roessingh Research & Development (RRD) joined the Rheuma network in order to provide the technological know-how in supporting and enabling telerheumatology services. This in light of different Dutch health care regulations and the need for improved inter-institutional rheumatology services.

Rheumatology requires a multidisciplinary approach across different lines and fields of expertise in health care, e.g., general practitioners, physiotherapists, rehabilitation physicians. The strategic objectives of the Rheuma network are to improve the efficiency and effectiveness of rheumatology services in order to meet patients' needs and care, across time and distance. In pursuing this objective, motivations mentioned by the network participants are to develop and formalise effective lines of communication between MST, LUMC and the respective local clinics, to leverage and share rheumatology expertise across the network, and to exploit Internet technology for forming the Rheuma network and enabling inter-institutional communication. The key enabling factor in the Rheuma network was the collaborative advantage by leveraging knowledge across the network and sharing expertise. Barriers to networking were building stakeholder commitment, communication and trust, spanning the traditional boundaries the

institutions, and financing the network technology and infrastructure (i.e., investments, costs, reimbursements). By commencing on a small experimental scale and funding by the Commission, these limiting factors and barriers were crossed.

Different stakeholders at different levels take part in the Rheuma network. From an institutional perspective, three constituencies form the network organisation:

- Medical Spectrum Twente (MST) and the *local* network of physiotherapists.
- Leiden University Medical Centre (LUMC) and the *local* network of physiotherapists.
- Roessingh Research & Development (RRD) and the Roessingh Rehabilitation Centre (RRC).

Within each institute different stakeholders are involved from levels of general management to the physiotherapists and rheumatologists (users) involved in the telerheumatology services. In total, approximately 180 professionals are involved in the Rheuma network, spread across the different levels and institutions.

Different processes are distinguishable in the functioning of the Rheuma network. Key management processes are network co-ordination and stakeholder management. Frequent face-to-face meetings take place to discuss experiences and future directions. The primary processes and transactions cover telerheumatology diagnosis processes: communication and decision-making; collaboration and knowledge sharing. Within these processes, the main network 'transactions' are the provision of telerheumatology services across the network, the leveraging of rheumatology expertise across the network, the development and supply of multimedia network technology. Technology development processes focused on application and infrastructure design. A multimedia database -'the post office'- based on Internet technology is used to facilitate the communication and diagnosis of rheumatology cases. Critical requirements are to support the current Rheuma network and to enable a-synchronous multimedia communication, in order to provide efficient, effective, flexible and reliable telerheumatology services. Organizational and learning processes are geared at human resource development and professionalisation.

The Rheuma network is developing in a phased manner according to three distinct levels of maturity: a 'pilot' phase, a 'learning' phase and an 'institutionalisation' phase [16]. Currently, the Rheuma network is moving on to the 'learning' phase. Having gained experience with setting up the network and getting 'a feel' for the other stakeholders and institutions, in phase 2 the Rheuma network is looking into new possibilities for effective communication (asynchronous and synchronous) and improved collaboration.

The experiences with the Rheuma network have been successful. Inter-institutional collaboration and communication have been enhanced and key stakeholders at all levels are satisfied and positive bout future networking opportunities. More specifically, stakeholders have experienced the 'collaborative advantage' of working together, sharing knowledge and developing expertise. Different stakeholders indicate that they are satisfied with the multimedia database application as it fits their needs to conduct asynchronous rheumatology diagnosis [16]. Because of the networking endeavours, RRD is rethinking is strategy and strategic position and looking into a new role as 'technology facilitator' or 'technology intermediary function'. One of the key issues and unresolved challenges in the Rheuma network is the sharing of costs (e.g. infrastructure) and risks (e.g. privacy).

3.3. The Case of the Australian Renal Telemedicine Network

The Queen Elizabeth Hospital (TQEH) provides a comprehensive range of specialist and diagnostic treatment services to the immediate community in western metropolitan Adelaide as well as country areas. TQEH is an undergraduate and postgraduate training hospital affiliated with the University of Adelaide and the University of South Australia.

TQEH's Renal Telemedicine Network (RTN) commenced in June 1994 [10,11,12]. Over 75% of patients are supported on haemodialysis and in South Australia the majority of these are located in 'satellite' centres. Problems which arise in delivering dialysis in these satellite units are numerous and include the maintenance of standards of care, initial training of staff, managing acute problems with patients such as incidental illness, maintenance of professional relationships and disciplines in a chronic care situation remote from senior management and assistance. These problems were managed by high cost options which involved either staff spending more time gaining a high initial skill level with regular updating at the parent institution or skilled personnel travelling to the site.

TQEH's RTN began with the expectation that telemedicine, involving the instantaneous transmission of live two-way video and audio, could provide a solution to a number of these challenges. Videoconferencing and related equipment were installed at its four renal dialysis centres at TQEH Woodville and Wayville (10 km from Woodville) in September 1994, and at North Adelaide (8 km) and Port Augusta (300 km) in February 1995. RTN dialyses a total of 145 patients at these four centres, with each patient normally dialysing three times per week and attending an outpatients clinic once every two months. The networked organisation also cares for 29 patients who dialyse at home.

The original aims of the network were to assess the feasibility and cost effectiveness of telemedicine as a means of improving the quality of patient care, determine the need for the further education of dialysis staff, and monitor dialysis processes and equipment at sites remote from the main dialysis institution. These aims were later expanded, to accelerate user adoption and to maximise the depth (number of users) and the breadth (telemedicine applications) of the network. The main issues identified by users in relation to telemedicine were clinical diagnosis and patient support, staff development and

administration. It was also decided to introduce telemedicine facilities incrementally and to win staff and patient support gradually. Two sites would be established in 1994 and two in 1995: TQEH Woodville and Wayville in September 1994, Port Augusta in February 1995 and North Adelaide in April 1995.

The main technology selected for the project was manufactured by PictureTel, which was on the State Government list of preferred suppliers and was able to meet all the technical specifications. While the PictureTel equipment came with a good reputation for ease of use and quality of audio, the units purchased were designed for boardrooms, not clinical settings, so modification of the equipment was required. After the initial equipment was purchased, a technology integration firm, Network Nomis, was engaged to provide technical assistance and advice. This required an iterative process with the project management team regarding alternative solutions to the functional specifications developed for the equipment.

Currently, the network links Woodville, Wayville and North Adelaide in the metropolitan area and Port Augusta (300km from Adelaide). Occasional links are also made to Clare (150km), Berri (250km), Mount Gambier (400km), Whyalla (400km) and Alice Springs (1,500km). The network is used about 3,000 times per year for many different clinical, educational and administrative functions, such as, dialysis access assessments, elective and emergency assessment, review of clinical dialysis problems and transplant investigational results, routine elective and outpatient consultations. Staff training on new equipment or on new procedures, delivered from TQEH to the satellite dialysis centres.

The network is now entering its third year. During this three-year period, RTN has moved on from a pilot project phase to a 'mature' network. The third year is also an opportunity to provide regular national services to locations such as the Northern Territory and international links to South East Asia. The RTN experiences demonstrates that the facilities are saving time and expenses for TQEH and patients and it clearly illustrates the role telemedicine can play in ensuring the quality and effectiveness of satellite centres not staffed by doctors. In the long term, the major savings from telemedicine may come from less obvious benefits such as improving the provision of services to patients, including dietician and pharmacist services, so that the health of dialysis patients does not deteriorate to the point of requiring hospitalisation. RTN also demonstrates that the cost effectiveness of telemedicine is enhanced by many intangible benefits such as improved staff development, staff cohesion, faster decision making and instant diagnosis. Benefits include travel, time and money savings, improved communication, increased quality of care, easier access to staff and patients, staff education and development and increased care unit cohesiveness and synergy.

3.4. Cross-Case Analysis and Interpretation

The within and cross-case analyses were guided by the theoretical framework and research questions, and followed pattern-matching and explanation-building approaches [24]. In conducting the cross-case analyses, patterns of differences and similarities were identified -independently by each of the researchers- and the results evaluated against the explanations offered by the framework and informed by the data. Constant reference was made to the theoretical framework and underlying relations in order to establish a clear chain of evidence. In this sense, the exposition of the research moved from objectives and questions, to specific data, and finally to interpretations and conclusions [16]. A summary of the analysis and interpretations is presented in Table 2.

Table 2. Network dimensions and key findings across cases

Network Dimension	BMCN Case	RRN Case	RTN Case
Strategic drivers and incentives for networking	Externally, to reduce costs. Internally, to improve efficiency and effectiveness in control resulting in reduced costs without loss of quality in hospital healthcare. Changes in organisation structure as a tool to improve efficiency and effectiveness.	Externally, to improve the efficiency and effectiveness of rheumatology services in order to meet patients' needs and provide collaborative advantage, through the exploitation of IT. Internally, to formalise effective lines of communication and develop expertise.	Externally, to improve the efficiency and effectiveness of renal dialysis services in order to meet patients' needs, through the exploitation of telemedicine. Internally, to improve communication and educate specialists, through the application of telemedicine.
Enabling conditions for the network	Evolution from a facility management into a product-line management organisation structure. Efficient and effective control of hospital organisations depends on ability to determine the relation between input and output. Changes demand a higher flexibility of IT.	Demand and supply mechanisms regarding rheumatology knowledge across the network Demand and supply mechanisms regarding IT knowledge across the network. Sharing of costs technical infrastructure, risks and privacy.	Demand and supply mechanisms regarding renal dialysis services across the network. Demand and supply mechanisms regarding telemedicine applications across the network. Management of change Funding and assistance from external stakeholders.
Design of the network	In a not-for-profit market barriers for exit and entry cannot be freely determined. Currently in a pilot phase.	Separate responsibilities for rheumatology services and IT services. Different functional roles and	Separate responsibilities for renal dialysis services and technology services. Different functional roles and

	Hospital-personnel and medical specialists work together to attend to the patients needs. HISCOM/Baan IT system is used to support hospital processes.	levels: sponsor, network co-ordinator, participants/users Enabling role of multimedia network technology.	levels: sponsor, network co-ordinator, participants/users, technology integrator.
Functioning of the network	Hospital middle management, functional operators and medical specialists and automation co-ordinator for the management of IT. Technical support, implementation and central computing facilities are outsourced. The budget for innovation is small.	Network and stakeholder management. Provision of telerheumatology services across the network. Leveraging of rheumatology expertise across the network. Demand and supply of multimedia network technology.	Network and stakeholder management. Provision of renal dialyses services across the network. Leveraging of renal dialyses expertise across the network. Demand and supply of telemedicine technology.
Performance of the network	Reduced costs without loss of quality in hospital healthcare. Contribution to mission statement. Networking reaches beyond organisational boundaries in transmural care projects.	Improved inter-institutional collaboration and communication. Efficient and effective rheumatology services. Stakeholder satisfaction Redefinition of stakeholder roles and positioning.	Improved inter-institutional collaboration and communication. Efficient and effective renal dialysis services. Stakeholder satisfaction Institutionalisation and growth.

4. Conclusion and Discussion

The case studies reported in this paper provide a number of important lessons learned for networked organisations in health care. In general, the case studies provide ample evidence that networked organisations are in a constant flux, driven and enabled by both external opportunities and internal needs. As the case studies discussed in this paper indicate, there is no such thing as 'one best' networked organisation in health care. Networked organisations come in different forms and shapes, and have different functions. More importantly, the case findings indicate that networked organisations develop through different phases of maturity and 'network-ability' as they migrate and grow synergistically. IT is certainly a key facilitator of this growth process. However, while IT enables the formation of professional networks in health care, it is ultimately the health care network constituency that determines the direction and development of the health care network [16]. With regard to the theoretical framework and dimension, the following conclusions are drawn from the case studies.

4.1 Lessons learned on strategic drivers and incentives for networking

The main strategic driver for networked organisation is the improvement of efficiency and effectiveness of the primary care process for meeting patients' needs and patient-information-streams. Different 'rationalities' exist for improving the efficiency and effectiveness of health care services. From an internal perspective, inter-organisational collaboration and expertise development are emphasised. In the external environment, the will to meet patients' needs is underscored.

The barriers for entry and exit of the networked organisation are described in general terms. This is due to the fact that healthcare is a merit good; entry and exit is regulated by the government, implying that central and local government organisations play a key role in developing network-centric health care services. Funding and financing of health care networks and the underlying IT infrastructure are of key importance.

4.2 Lessons learned on enabling conditions for the network

The important lesson learned in all cases is the critical role played by management and the process of managing stakeholders' needs and expectations, and inter-organisational change. Managing the demand and supply of care and technology is a key enabler of networked organisations in health care. On one hand, there is the need to share and collaboratively develop health care expertise. On the other, there is also the need to apply IT to facilitate the efficient and effective delivery of health care services. Proper attention to organisational, political and human issues can not be overstated enough in the development of successful networked organisations, especially in health care where professionals carry the 'power to innovate' [16]. While IT may provide the conditions for networking, it is the organisation, its professionals and management that ultimately drive networking.

4.3 Lessons learned on the design of the network

Regarding the design of networked organisations in health care, the case studies cover a spectrum from inter-organisational (the RRN and RTN cases) to intra-organisational and inter-departmental (the BMCN case) networked organisation. Furthermore, each case covers a different phase of growth: piloting (the BMCN case), learning (the RRN case) and growing (the RTN case). Interesting is also the growth of IT during these different phases. This growth in IT is readily recognised in the RRN and RTN cases in which telemedicine technologies are applied in more organisational functions as the network grows. During these phases, telemedicine applications are modified and redesigned to meet the needs of users and the different clinical, educational and administrative services.

4.4 Lessons learned on the functioning of the network

In the functioning of networked organisations in health care different functions and processes are distinguished. Health care transactions, in the form of patient-information streams and clinical communication, between health care service providers are at the core of the network functioning. Network management and co-ordination are likewise important and organised through both formal and informal mechanisms in which key stakeholders take part. With regard to network functions, different clinical, administrative and educational processes place their requirements on IT applications. While it is claimed that IT enables communication and collaboration in the networked organisation, the case studies suggest that communication and collaboration are equally important for the effective utilisation of IT in developing networked organisations in health care [16].

4.5 Lessons learned on the performance of the network

The ability to describe and measure the performance of the network increases when a higher phase of growth has been reached. In the piloting phase, performance measures are described in general terms, repeating the mission statement. In the learning phase, performance is likewise described in general terms, with a focus on stakeholder expectations and networking agreements. Stakeholder roles are redefined and the performance is assessed in terms of stakeholder satisfaction. In the growing phase, stakeholder roles have been institutionalised and the 'benefits' of networking become clear. These include health care efficiency and effectiveness gains, professionalisation and expertise development, and stakeholder satisfaction. The financial performance of the network remains difficult because the relation between input and output in a healthcare organisation is hard to determine. Moreover, 'traditional' cost-benefit analyses of networked organisations in health care are sub-optimal because they fail to account for all the (inter-/intra-organisational) changes that occur as a result of networking [16].

4.6 Lessons learned on the role and impact of information and communication technology

With regard to the role and impact of IT in networked organisations in health care, the case studies indicate that IT plays an important role in each of the network dimensions as described above. However, it is the network constituency that needs to recognise, adopt, implement and exploit the potential opportunities provided by IT. While IT enables the formation of professional networks in health care, it is ultimately the health care network that drives and determines the acquisition and application of IT in the networked organisation [16]. The cases indicate that IT requires constant modification to meet the specific needs of the health care network functions, and that the IT supplier to the network organisation needs to be actively involved in the different stages of network formation and professionalisation. While Internet and other networking technologies are readily available to health care networks, it is ultimately the appropriate use and effective application of IT that determines its impact.

4.7. Future Research

As described in the foregoing sections, this exploratory study provides a number of lessons learned on networked organisations in health care. The case studies describe emerging practices and phases of networking in health care. Networked organisations are in a constant flux, driven and enabled by both external opportunities and internal needs, addressing both organisational and IT-oriented issues. Research is on-going in this field, and currently other cases in the (international) health care sector are being studied in the second phase of a research programme on networked organisations.

As part of a long-term research programme on networked organisations in health care, and other industries, future research is geared at (*i*) analysing and understanding emerging business models of networked organisations, and the supporting and shaping role of IT infrastructures and applications, and (*ii*) providing directions and guidelines for developing and migrating towards networked organisations, and the implications and requirements for IT. In particular, current and future research is focused on identifying and explaining practices and characteristics (i.e., strategy, structure, processes, governance, stakeholders, and technology) of 'high-performance' networked organisations in different phases of development. Understanding what 'high-performance' networked organisations are, and how they transform through different phases of development, remains a grey area in the literature on networked organisations, and a key challenge for future research!

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